# HAKUBI RESEARCHERS' ACTIVITIES IN ICR

**Hakubi Project: Fosterage and Support of Young Researchers, Kyoto University**

## Research Topic

**Algorithmic Graph Theory with Applications to Bioinformatics**

Program-Specific Assoc Prof
JANSSON, Jesper
(Ph D)

**Host Laboratory** Laboratory of Mathematical Bioinformatics

**Host Professor** AKUTSU, Tatsuya

### Outline of Research

One of my research topics this year is fast matrix multiplication.Given two square matrices A and B of size (n x n) with nonnegative integer entries, the naive algorithm for computing the matrix product AB runs in O(n^{3}) time. There exist algorithms that run in substantially subcubic time, e.g., a very recent one due to F. Le Gall uses O(n^{2.3728639}) time, and a major open question in Theoretical Computer Science is whether it can be done in quadratic time. We have developed a new technique based on interpreting matrices as 3D histograms. To multiply A and B, we decompose their 3D histograms into 3D blocks which are then manipulated in a pairwise manner using the interval tree data structure. This leads to an O*(n^{2} + rs)-time algorithm for matrix multiplication, where r and s denote the minimum number of 3D blocks into which A and B can be partitioned, respectively. In other words, whenever A and B admit a partition into a small number of 3D blocks, our algorithm is very efficient.